Characteristics and Correlates of Asthma in a University Clinic Population*

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To contribute more comprehensive information about the characteristics of asthma, this article analyzed patients served by the University of Alabama at Birmingham Comprehensive Asthma Program. Their physicians rated one fifth of these patients as having "severe" asthma with the remainder about equally divided between "moderate" and "mild." One in two first received a diagnosis of asthma ten or more years previously. Common comorbidities were hypertension, obesity, rhinitis, bronchitis, sinusitis, and arthritis. One half had visited an emergency room or been hospitalized for asthma in the past year. Inhaled bronchodilators and continuous theophylline were the most commonly prescribed medications. Side effects, especially tachycardia and insomnia, were common and almost exclusively associated with theophylline or corticosteroid therapy. Spirometric assessment showed chronic airflow obstruction in those with more severe asthma. Prevalence of respiratory symptoms, intensity of medication regimen, incidence of side effects, and health care utilization increased as asthma severity increased. *(Chest 1990; 98:821-28)*

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Asthma in adults contributes substantially to morbidity, mortality, and health care costs in the United States. More than 3 percent of total outpatient visits are attributable to asthma.[1] In 1983 there were 459,000 hospitalizations for asthma and 3,440 deaths listing asthma on the death certificate as the underlying cause of death; an additional 4,000 deaths recorded asthma as a comorbidity factor.[2] The epidemiology of asthma is not completely understood, and recommendations for research to clarify this issue were presented in a recent review.[3] The present article is a step in addressing these recommendations.

The Comprehensive Asthma Program at the University of Alabama at Birmingham (UAB) was established in 1981 to coordinate diagnostic and therapeutic services for inpatient and outpatient adult asthma care. The present article summarizes characteristics of the adult asthma population who received outpatient care at UAB. We examined demographic characteristics, comorbidity, pulmonary function, asthma severity and symptoms, medication patterns, and health care utilization. Because UAB is a tertiary care institution, these patients may not represent the population of adults with asthma in Birmingham and also may or may not be completely representative of populations at other university-based asthma care programs. Therefore, this report is no substitute for comprehensive epidemiologic studies, but it is an important step in developing baseline data for nonhospitalized adult populations receiving treatment for asthma.

Methods and Materials

Subjects

Much of the data were collected in connection with a study funded by the National Heart, Lung, and Blood Institute (Bethesda, Md) to evaluate a special educational program designed to improve the self-management skills of adults with asthma.[4,5] Subjects were recruited from an overall pool of 479 adults who had received treatment in the UAB Asthma Program. Basic demographic and comorbidity data were collected for these patients from clinic records. Data with respect to asthma severity and duration were collected for a smaller set of 366 patients who were screened for participation in the clinical intervention during regular clinic visits. The primary data for the present research, however, were based on the 263 (73 percent) screened patients who meet the eligibility criteria listed below and were willing to participate. (Only 11 eligible subjects refused to participate.) Data were collected from those 263 patients through a combination of physician ratings, structured interviews, and questionnaires. The eligibility criteria included the following: (1) age 17 years or older; (2) recurrent episodes of wheezing or dyspnea; (3) sufficient history available to categorize asthma severity; (4) objective evidence of airway obstruction during episodes; (5) objective evidence of improved airflow when symptom free; (6) asthma severe enough to require some medication at the time of randomization; and (7) absence of chronic or debilitating disease that would compromise interpretation of data.

Demographic Characteristics and Comorbidity

Data from clinic records were used to examine the basic charac-

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teristics of the patient population served by UAB. Demographic characteristics included sex, race, age, and marital status. Data were also obtained for the following major types of comorbidity: hypertension, obesity, rhinitis, bronchitis, sinusitis, arthritis, diabetes mellitus, and chronic obstructive pulmonary disease (COPD).

Asthma Severity and Duration

Asthma severity was assessed by the regular pulmonary physician of each patient screened for the self-management study. Physicians were asked only to classify each patient as having mild, moderate, or severe asthma, using specific written guidelines. These guidelines emphasized that physicians were to rate the severity of the underlying disease, not status during a particular episode. A series of studies yielded results strongly supporting the usefulness and appropriateness of these simple ratings.[6-8]

Asthma duration was assessed in terms of the number of years since the patient first received a diagnosis of asthma. We used a three-point scale with the following categories: (a) less than 10 years, (b) 10 to 29 years, and (c) 30 years or more.

Baseline Research Interview

A baseline research interview was conducted with each subject entered into the self-management study. This interview was structured to characterize each patient's asthma and its impact on lifestyle.[9] Data are organized into the following categories: (1) background characteristics; (2) smoking patterns; (3) pulmonary function; (4) asthma symptoms; (5) respiratory illnesses and symptoms; (6) medication regimens, adherence, and side effects; and (7) health care utilization.

Background Characteristics and Smoking Patterns

The baseline interview included questions about the following background characteristics: educational level, number of children, employment status, and third-party coverage for medical care costs. Both active and passive smoking were assessed.

Pulmonary Function

Pulmonary functioning was measured through spirometric assessment. Three measures were obtained: (a) forced vital capacity (FVC), (b) forced expiratory capacity in 1 s (FEV_1), and (c) ratio of FEV_1 to FVC.

Asthma Symptoms

Two sets of measures were used by the patients to subjectively assess their asthma. The first consisted of six "bother scales" in which subjects rated the amount of distress caused by asthma on a four-point scale ranging from a score of *1* for "not at all bothered, no symptoms" to a score of *4* for "severely bothered, unable to function." The six scales assessed the extent to which patients "typically" were bothered in the winter, spring, summer, and fall, and the extent to which they had been bothered in the past seven days and in the past 24 hours.[7] The second measure used the Asthma Symptoms Checklist,[9] a 36-item Likert-type scale developed at the National Asthma Center–National Jewish Hospital[10] to analyze the incidence of five types of symptoms—airway obstruction, fatigue, irritability, panic-fear, and hyperventilation—during asthma attacks. Scores ranged from *1* for "never" occurring as part of an attack to *5* for "always" occurring.

Respiratory Illnesses and Symptoms

Subjects were asked whether they had experienced any episodes of the following respiratory illnesses during the past 12 months: (a) prolonged shortness of breath, (b) colds, upper respiratory tract infections, (c) spells of coughing, (d) bronchitis, and (e) pneumonia. Similarly, patients were asked if they had experienced the following respiratory symptoms during the past seven days: (a) shortness of breath, (b) coughing, (c) wheezing, (d) decreased exercise tolerance, (e) increased sputum, (f) thick sputum, and (g) green or yellow sputum.

Medication

The interview provided information about whether the recommended medication regimen for each patient included (a) an inhaled bronchodilator, (b) continuous theophylline, (c) two or more courses of steroids in the past year, (d) some other inhaled medication, and (e) two or more courses of antibiotics in the past year. Two six-item scales assessed adherence to the recommended oral and inhaled medication regimens. These scales were based on the prototypic scale described by Morriskey et al.[11] The wording was changed slightly to be more applicable to asthma, and items were added to assess overuse.

Previous research has indicated that improper use of inhalers is a significant problem in adults with asthma.[12] Therefore, a ten-item observational checklist to assess inhaler use skills was developed and demonstrated to have good measurement characteristics.[9] Each of these three scales was scored in terms of whether each patient was adherent on *all* items in the scale. This score represents the desirable level of adherence, not an extraordinary level.

Medication side effects can be a significant problem in the management of adult asthma. Therefore, subjects were asked if they had experienced the following side effects in the past three months: (a) pounding heart (tachycardia), (b) insomnia, (c) nausea, (d) bad dreams, (e) white spots in the mouth (oral thrush), (f) seizures, and (g) "any other side effect of your asthma medicine."

Health Care Utilization

Poor self-management of adult asthma may produce overutilization of health care resources. To address this issue, subjects were asked if a respiratory problem had caused the following events during the past year: (a) telephone call to a physician, (b) office visit to a physician, (c) emergency room visit, and (d) hospitalization.

Statistical Analysis

The results are reported for the entire sample and, in most cases, they are broken down by asthma severity. In a few cases, the results are also broken down by duration of asthma or by type of medication. (Additional analyses that are not reported herein found no consistently significant impact of asthma duration on the various measures.) Differences were tested for statistical significance through χ^2 for categoric measures and through F or t tests for continuous measures. It should be remembered that the varying numbers of patients whose data are reported in the tables are due to whether or not patients visited the UAB clinic during the data collection period and to the eligibility and willingness of patients to participate in the clinical intervention. The Ns also vary somewhat among variables because data were missing for some patients on specific variables (particularly on the Asthma Symptoms Checklist). However, no systematic differences are present between patients with such missing data and patients with complete data.

Results

Table 1 summarizes demographic characteristics and prevalence of comorbidity for asthma patients at UAB. Female patients predominated in the UAB population, confirming results of other studies of adult asthma clinics[13] but differing from most epidemiologic studies.[14-16] The proportion of whites in this study was consistent with the racial makeup of the population of the Jefferson County (Birmingham) area. The age distribution in the UAB clinic population was broad

Table 1—*Demographic Characteristics and Comorbidity of Patients Served by the UAB Clinic**

	Total Pool, % (N = 479)	Screened for Self-Mgmt Study (N = 366) %	χ^2	Entered into Self-Mgmt Study (N = 263) %	χ^2
Sex					
Female	66.4	67.2	0.47	65.8	0.10
Male	33.6	32.8		34.2	
Race					
White	65.1	67.4	3.55	67.3	1.22
Black	34.9	32.6		32.7	
Age, yr					
<30	19.7	16.4	13.81†	16.0	9.56‡
30-49	37.8	37.5		37.0	
50-69	30.7	33.7		35.9	
≥70	11.8	12.3		11.1	
Marital status					
Never married	22.1	19.7	5.65	18.3	5.26
Formerly married	16.5	16.4		17.6	
Currently married	61.4	63.4		64.1	
Comorbidity					
Hypertension	21.5	21.6	0.01	24.0	2.08
Obesity	9.8	9.3	0.48	9.5	0.06
Rhinitis	8.6	9.0	0.41	8.4	0.03
Bronchitis	8.6	8.5	0.02	8.0	0.25
Sinusitis	6.7	6.8	0.06	7.2	0.28
Arthritis	5.4	6.6	3.86‡	6.1	0.49
Diabetes mellitus	4.4	4.6	0.25	5.3	1.23
COPD	3.8	2.5	7.24†	1.9	5.56‡

*Note: χ^2 compared screened and entered patients with the remainder of the total pool of patients.
†$p<0.01$.
‡$p<0.05$.

with 42 percent of patients being age 50 years or older. Marital status percentages were consistent with the norms for the age and sex distributions.

Hypertension was the most common (22 percent) comorbidity factor. Obesity, rhinitis, bronchitis, sinusitis, and arthritis also were present in 5 percent or more of the patients. These results are consistent with the demographic characteristics of UAB patients and suggest that asthma patients are much like the general population in terms of the presence of various health problems.

Table 1 also compares the three groups of patients who provided data for this study. The results for the three groups are highly similar, with the only consistently significant differences indicating that screened and entered patients were less likely to fall in the youngest age category and less likely to have COPD. (Our eligibility criteria eliminated patients with severe chronic pulmonary obstruction.) Therefore, these results indicate that information based on screened and entered patients can be generalized to the UAB asthma population with considerable confidence.

Additional analyses for patients entered into the self-management study found no relationship between asthma severity and educational level, number of children, employment status, third-party health care coverage, smoking status, or exposure to passive smoking. Only 15.4 percent of the study population were current smokers, a substantially lower proportion than in the general population.[19] The study population included a substantial proportion of female former smokers (47.0 percent), indicating smoking cessation rates among this sample were higher than in the general population of female subjects.[20] With regard to passive smoking, we found that exposure at work was more common (for those who worked) than exposure at home.

Table 2 summarizes the relationship between asthma severity and asthma duration. The UAB physicians rated 40.2 percent of those patients as having mild asthma, 42.3 percent as having moderate asthma, and 17.5 percent as having severe asthma. The clearest trend in this table is that patients with milder disease

Table 2—*Asthma Severity and Duration in Patients Screened for the Self-Management Study (N = 319)*

Years Since First Asthma Diagnosis	% of All Patients	% of Patients Whose Asthma Is: Mild	Moderate	Severe	χ^2
<10	48.0	60.0	40.0	40.7	12.14*
10-29	35.1	28.0	40.0	39.0	
≥30	16.9	12.0	20.0	20.3	
Total	100	100	100	100	

*$p<0.05$.

Table 3—*Pulmonary Function in Patients Entered into the Self-Management Study*

	FVC% of Predicted, Mean ± SD		FEV$_1$% of Predicted, Mean ± SD		Ratio of FEV$_1$ to FVC, Mean ± SD	
All entered patients (N = 238)	76.0	19.5	69.0	23.5	72.8	14.1
Entered patients whose asthma is (N = 238)						
Mild	80.6	17.9	77.6	21.9	77.1	12.9
Moderate	74.7	19.4	68.3	21.7	74.1	12.0
Severe	69.8	21.2	53.5	23.0	60.5	14.9
F	4.92*		17.2*		24.8*	
Entered patients who have had asthma (N = 214)						
<10 yr	75.9	20.0	71.3	24.6	75.0	14.6
10-29 yr	77.3	20.2	66.7	23.4	71.8	13.7
30+ yr	73.7	15.6	62.3	18.6	68.4	13.2
F	0.39		1.77		3.04*	
Entered patients who smoked (N = 206)						
Never	76.4	18.6	70.9	21.3	74.6	12.7
Formerly	74.2	19.1	65.3	24.1	70.2	15.8
Currently	70.7	17.8	63.5	22.0	72.0	14.6
F	1.15		1.98		2.09	

*$p<0.01$.

Table 4—*Asthma Symptoms in Patients Entered into the Self-Management Study*

	All Entered Patients, Mean ± SD		Entered Patients Whose Asthma Is: Mild, Mean ± SD		Moderate, Mean ± SD		Severe, Mean ± SD		F
Extent to which asthma symptoms have bothered patient (N = 249)									
During past 7 days	2.53	1.19	2.12	1.01	2.63	1.20	3.13	1.24	12.44*
In past 24 h	2.26	1.19	1.81	0.95	2.34	1.18	2.98	1.27	16.72*
Usually during the									
Spring	2.96	1.06	2.78	1.14	3.14	0.97	2.96	1.05	2.98
Summer	2.52	1.06	2.34	1.05	2.62	1.02	2.65	1.14	2.17
Fall	2.89	1.07	2.47	1.06	3.13	1.01	3.09	0.95	11.61*
Winter	2.61	1.13	1.46	1.10	2.93	1.08	3.23	1.18	5.36*
Frequency with which asthma attacks include symptoms of (N = 136)									
Airway obstruction	3.59	0.93	3.59	1.01	3.40	0.88	4.06	0.77	4.17†
Fatigue	3.23	1.21	3.31	1.27	2.98	1.23	3.71	0.57	3.13†
Irritability	2.63	1.03	2.73	1.17	2.31	0.87	3.24	0.56	7.41*
Panic and Fear	2.31	1.04	2.08	0.89	2.09	0.86	3.34	1.20	16.05*
Hyperventilation	1.94	0.78	1.97	0.90	1.88	0.66	2.05	0.61	0.41

*p<0.01.
†p<0.05.

had had their conditions diagnosed more recently.

The results of spirometric assessments are summarized in Table 3. The overall pulmonary function means are low. There is a clear-cut relationship between the severity of asthma and level of impairment in both volumes and flow rates, but the flow rates, particularly the FEV_1, show a significantly greater decline as asthma becomes more severe. These results support results from previous studies[15] that suggested that flow rates decrease with increasing number of years from diagnosis. There is no correlation between impairment in pulmonary function and passive smoking and only a slight correlation is seen between current smoking status and reduction in FEV_1/FVC.

Results for asthma symptoms are summarized in Table 4. There is no clear-cut pattern of asthma symptoms being increasingly bothersome during the spring or summer; instead, fall and winter seem to be associated with more bothersome asthma symptoms in the UAB population. Symptoms experienced during the past seven days and the past 24 hours were a greater problem in patients with increasingly severe asthma. These results appear consistent with the data for asthma provided by the National Health Interview Survey.[2] The Asthma Symptoms Checklist results indicate that hyperventilation was seldom seen in the UAB population, but airflow obstruction, fatigue, irritability, and panicky reactions to asthma attacks

Table 5—*Respiratory Illnesses and Symptoms in Patients Entered into the Self-Management Study*

	% of All Entered Patients	% of Entered Patients Whose Asthma Is: Mild	Moderate	Severe	χ^2
Respiratory illnesses experienced in past 12 mo (N = 260)					
Prolonged shortness of breath	75.4	67.4	74.8	93.5	11.43*
Cold, upper respiratory tract infection	67.3	66.3	68.9	65.2	0.27
Spell of coughing	58.5	54.7	56.3	71.7	4.11
Bronchitis	40.0	36.8	43.0	37.0	1.25
Pneumonia	9.6	6.3	13.4	6.5	3.71
Respiratory symptoms experienced in past 7 days (N = 262)					
Shortness of breath	67.9	57.9	71.4	80.4	8.38†
Coughing	67.2	54.7	75.6	71.7	10.98*
Wheezing	65.6	50.5	71.4	82.6	17.29*
Decreased exercise tolerance	51.9	38.9	56.3	67.4	11.73*
Increased sputum	41.6	32.6	46.2	50.0	5.50
Thick sputum	30.2	23.2	31.1	43.5	6.10†
Green or yellow sputum	17.9	16.8	17.6	21.7	0.53

*p<0.01.
†p<0.05.

Table 6—*Medication Regimens and Adherence in Patients Entered into the Self-Management Study*

	% of All Entered Patients	% of Entered Patients Whose Asthma Is			
		Mild	Moderate	Severe	χ^2
Medications recommended (N = 261)					
Inhaled bronchodilator	89.7	85.4	90.8	95.7	3.80
Continuous theophylline	87.4	75.0	94.1	95.7	21.06*
More than 1 course of steroids in past yr	41.2	20.0	45.4	73.9	36.82*
Another inhaled medication	36.8	26.0	42.9	43.5	7.53†
More than 1 course of antibiotics in past yr	27.6	29.2	23.5	34.8	2.29
Total No. of medications in recommended regimen (N = 261)					
0	1.1	3.1	0.0	0.0	41.13*
1	9.2	15.6	6.7	2.2	
2	31.8	44.8	26.1	19.6	
3	30.3	19.8	39.5	28.3	
4	19.2	12.5	19.3	32.6	
5	9.4	4.2	8.4	17.4	
Adherent to recommended regimen on all					
6 medication items	49.1	51.3	45.9	53.3	0.91
6 inhaler items	23.9	27.7	20.2	26.1	1.61
10 inhaler use items	13.1	8.0	13.8	22.5	5.09

*p<0.01.
†p<0.05.

were common. Airflow obstruction was the most common symptom complex. There is a clear-cut increasing relationship with increasing severity for the symptom checklist scales, with the relationship more prominent for irritability and panic-fear.

The results in Table 5 indicate that patients experienced a variety of respiratory illnesses in the year prior to interview. Seventy-five percent of patients experienced episodes of shortness of breath, and only shortness of breath was related to increasing severity of asthma. Many patients experienced significant symptoms during the seven days prior to interview (a period short enough to be remembered accurately). Coughing, shortness of breath, and wheezing occurred with about equal frequency. All assessed symptoms, with the exception of increased sputum and green or yellow sputum, were more likely to occur in patients with more severe asthma.

Table 6 indicates that there was significant variability in the number of medications used by individual patients but most patients were taking two or three medications. Some patients were taking as many as five medications and a very small number, 1.5 percent with mild asthma, were receiving no medication at the time of data collection. In this asthma population, inhaled adrenergic agents were the most commonly used medications. Most patients took both theophylline and an inhaled adrenergic medication. A substantial proportion, about 35 percent, of patients received more than one course of steroids per year. About 32 percent used another inhaled medication, most often inhaled steroids. About 24 percent of patients received more than one course of antibiotics per year. Of the standardly recommended medications, only continuous theophylline, more than one course of steroids, and use of another inhaled medication were related to severity. Continuous theophylline was seldom used in the treatment of the mild asthma.

The overall level of adherence in the UAB population was quite low, with less than half the patients

Table 7—*Side Effects of Medication in Patients Entered into the Self-Management Study*

Side Effects Experienced in Past 3 mo (N = 256)	% of All Entered Patients	% of Entered Patients Whose Asthma Is			
		Mild	Moderate	Severe	χ^2
Tachycardia	46.9	35.3	52.9	52.2	6.91*
Insomnia	41.0	27.8	47.1	50.0	9.86†
Nausea	24.6	17.8	29.4	26.1	3.79
Bad dreams	10.2	8.9	10.1	13.0	0.56
Oral thrush	9.0	2.2	11.8	15.2	8.31*
Seizures	2.0	1.1	0.8	6.5	6.09*
Other	33.6	24.4	37.8	39.1	4.97

Relationship of Incidence of Side Effects to Type of Medication (N = 256)	Total No. of Side Effects in Past 3 mos for Those				
	Not Taking, Mean ± SD		Taking, Mean ± SD		t
Inhaled bronchodilator	1.44	1.97	1.69	1.43	0.65
Continuous theophylline	1.16	1.53	1.74	1.41	2.11*
More than 1 course of steroids	1.41	1.35	2.04	1.48	3.45†
Another inhaled medication	1.71	1.45	1.59	1.42	0.64
More than 1 course of antibiotics	1.57	1.36	1.90	1.55	1.59

*p<0.05.
†p<0.01.

Table 8—*Health Care Utilization in Patients Entered into the Self-Management Study (N = 257)**

	% of All Entered Patients	% of Entered Patients Whose Asthma Is			
		Mild	Moderate	Severe	χ^2
In the past year has					
Called a physician about a respiratory problem	43.2	37.6	41.5	58.7	5.81
Visited a physician for a respiratory problem	49.0	43.0	44.9	71.7	11.64†
Visited an emergency room for a respiratory problem	41.2	26.9	47.5	54.3	13.06†
Been hospitalized for a respiratory problem	27.6	16.1	28.8	47.8	15.62†
Visited emergency room *or* hospitalized	48.6	32.3	55.1	65.2	17.02†
Total No. of types of care used					
0	26.5	35.5	22.9	17.4	30.83†
1	21.8	21.5	27.1	8.7	
2	26.8	30.1	24.6	26.1	
3	14.0	9.7	15.3	19.6	
4	10.9	3.2	10.2	28.3	

*Note: entries are percents of columns.
†$p<0.01$.

adhering to the recommended medication regimen, less than 25 percent to the inhaler regimen, and only about one patient in six using inhalers correctly. These adherence levels were highly similar to those of other chronic adult diseases for which programs to improve self-management practices improved functional status and reduced overutilization of health care services.[21]

The information in Table 7 indicates that medication side effects were common, with 55 percent of patients experiencing tachycardia and 46 percent experiencing insomnia. Thirty-six percent of patients experienced some side effect other than those specifically listed on the questionnaire, and 28 percent experienced nausea. Tachycardia, insomnia, and bad dreams were more likely to occur in patients with severe asthma. On the other hand, "other" side effects were most likely to occur in patients with moderate asthma.

The impact of taking vs not taking each of the individual medications on side effects is also examined in Table 8. Although the side effect score was higher when individuals took any medicine, regardless of which medicine it was, only continuous theophylline and more than one course of steroids in the past year showed a statistically significant difference.

Table 8 summarizes the results for health care utilization. The absolute level of health care utilization was fairly high, with nearly half of the study patients having visited an emergency room, having been hospitalized, or having done both for a respiratory problem in the past year. All forms of health care, other than calling a physician about a respiratory problem, were used more by patients with more severe asthma.

Discussion

Asthma is a very common disease, treated by a variety of physicians, including general internists, pediatricians, family practitioners, and other primary care providers. Many questions remain unanswered about the current status of diagnostic accuracy and about the best treatment for asthma patients. This analysis of characteristics and correlates of asthma in a university clinic population is an important step in defining what is known and in indicating areas in which further asthma research is needed.

Previous epidemiologic data indicate that among children, boys are more likely to have asthma.[16-18] Although the National Institute of Allergy and Infectious Diseases (NIAID) task force concluded in 1979 that being male is a risk factor for asthma,[1] other reports suggest that asthma prevalence either does not differ between adult men and women[14,15] or that adult women predominate in clinic populations.[13] The predominance of female subjects in the UAB population confirms these latter results. There has been no satisfactory explanation of this apparent discrepancy between epidemiologic and clinical results. Several explanations are possible: (a) femaleness may really be a risk factor for asthma in adults, (b) female subjects may seek medical care more frequently than male subjects, or (c) diagnostic discrepancies are possible between the sexes, especially in older adults because it is difficult to distinguish airflow obstruction caused by asthma from that caused by chronic bronchitis and/or emphysema.[22] International Classification of Disease Code[23] lists many diagnostic possibilities for airflow obstruction, including nonspecific terms such as COPD, chronic bronchitis, bronchiolitis, etc. Therefore, the diagnosis of airflow obstruction is difficult and complex and could be influenced by diagnostic bias. Specifically, some investigators have suggested physicians tend to diagnose male subjects who smoke and wheeze as having COPD and female subjects with the same symptoms as having asthma.[16]

A broad age range of asthmatics has been noted,[22] extending from early childhood through late adulthood with peak ages of prevalence between 5 and 14 years

and 50 to 70 years.[18] Previous spirometric studies have suggested an association between asthma and chronic airflow obstruction, with the loss of pulmonary function being greater in persons with more severe asthma.[24] Also, the "Dutch Hypothesis," which holds that among persons predisposed to asthma those who smoke are at the greatest risk of chronic obstruction,[25] has won increasing acceptance in recent years.

The data in Table 3 provide confirmation that a progressive decline in pulmonary function is associated with asthma of long duration. This decline has major implications for the natural history of asthma and provides circumstantial evidence for the clinical impression that asthma itself may be a risk factor for irreversible airway obstruction. The data in this table do not support the "Dutch Hypothesis," however, in that no relationship was found between smoking status and pulmonary function. This lack of relationship strengthens the evidence that the mere presence of asthma is the relevant risk factor for chronic obstruction.

Moreover, the data in Table 3 may underestimate the relationship between asthma duration and decline in pulmonary function. The data in Table 2 indicate that only 16.9 percent of the sample had received a diagnosis of asthma 30 or more years ago. This proportion is surprisingly small, and one possible explanation involves our decision to exclude all patients with chronic or disabling diseases. Over a period of 30 years or longer, the primary diagnosis for patients whose pulmonary function has declined progressively may have changed from asthma to COPD. Such patients would not have even been considered for the present study and thus would have reduced the number of long-duration asthma patients with severe obstruction. Alternative explanations can be proposed for the small proportion of long-duration patients, such as the possibility that many patients who received an asthma diagnosis many years ago are dead or the possibility that remission rate increases with asthma duration. The present data do not permit a decision among these possible explanations, and the implications of a relationship between asthma and irreversible airway obstruction are important enough to justify research directly addressing the issue.

We believe the Bother Scales will be valuable for future studies in education and behavioral research and in pharmacologic and immunologic research. Increased asthma symptomatology in the UAB population seems to be associated with fall and winter. Ragweed exposure is greatest during the fall in Birmingham, Ala, and the fall and winter are associated with increasing viral infections and increased exposure to fungal spores. Careful observation of immunologic phenomena during the fall may be required to understand this problem. It is somewhat surprising that we did not observe greater variation among the seasons. Birmingham has a warm, moist climate, and greater seasonal variation might be observed in areas with longer, colder winters. Symptoms during the past seven days as well as the past 24 hours were more bothersome in patients with increasingly severe asthma.

The frequency with which respiratory symptoms occurred in the UAB asthma population confirms the difficulty of achieving a symptom-free state even under careful monitoring and treatment. The frequency of coughing as a symptom is important as it appears greater than would be expected from current literature.[23] Because asthma is a common diagnosis and cough is a common presenting symptom, these results suggest that assessment of pulmonary function, including measurement of flow rate and bronchial reactivity, should be considered in all patients who cough without any other obvious reason.

Medications typically prescribed for adults with asthma are those intended to prevent or reverse airflow obstruction. These medications vary from periodic use of inhaled adrenergics to multiple drug regimens, at times including systemic corticosteroids.[26] Theophylline and, to an even greater extent, steroids are the medications most likely to cause side effects. The relationship between the use of medications with side effects and severity of asthma raises important risk-benefit issues. Carefully controlled studies of the specific benefits and disadvantages of medication regimens need to be conducted to better define which patients should receive which regimen. Large prospective studies will most likely be required to answer these important therapeutic questions.

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REFERENCES

1 National Institute of Allergy and Infectious Disease (NIAID). Asthma and other allergic disease. Report of NIAID Task Force. Washington, DC: US Government Printing Office, 1979. NIH publication (PHS)79-387

2 Evans R, Mullaly DI, Wilson RW, Gergen PJ, Rosenberg HM, Grauman JS, et al. National trends in the morbidity and mortality of asthma in the U.S.: prevalence, hospitalization and death from asthma over two decades: 1965-1984. Chest 1987; 91:65-74S

3 Burney P, Detels R, Higgins M, Peckham C, Samet JM, Tager IB. Recommendations for research in the epidemiology of asthma. Chest 1987; 91:194-95S

4 Bailey WC, Richards JM, Manzella BA, Windsor RA, Brooks CM, Soong SJ. Promoting self-management in adults with asthma: an overview of the UAB program. Health Educ Q 1987; 24:345-55

5 Bailey WC, Richards JM, Manzella BA, Windsor RA, Brooks CM, Soong SJ. Improving self-management skills of adults with asthma. Am Rev Respir Dis 1989; 139:144A

6 Bailey WC, Soong S, Brooks CM, Windsor RA, Richards JM,

Goetter WE. Demographics, co-morbidity, and medication in an asthma population. Chest 1987; 92:122S
7 Richards JM, Bailey WC, Windsor RA, Martin B, Soong S. Some simple scales for use in asthma research. J Asthma 1988; 25:363-71
8 Brooks CM, Richards JM, Bailey WC, Martin B, Windsor RA, Soong S. Subjective symptomatology of asthma in an outpatient population. Psychosom Med 1989; 51:102-08
9 Manzella BA, Brooks CM, Richards JM, Windsor RA, Soong S, Bailey WC. Assessing the use of metered dose inhalers by adults with asthma. J Asthma 1989; 26:223-30
10 Kinsman RA, Luparello T, O'Banion K, Spector S. Multidimensional analysis of the subjective symptomatology of asthma. Psychosom Med 1973; 35:250-67
11 Morriskey DE, Green LW, Levine DM. Concurrent and predictive validity of a self-reported measure of medication adherence. Med Care 1986; 24:67-74
12 Epstein SW, Manning CD, Ashley MJ, Correy PN. Survey of the clinical use of pressurized aerosol inhalers. Can Med Assoc J 1979; 120:813-16
13 Pedersen PA, Weeke ER. Asthma in Danish general practice: prevalence and consultation. Allergy 1981; 36:175-81
14 Broder I, Higgins MW, Mathews KP, Keller JB. Epidemiology of asthma and allergic rhinitis in a total community, Tecumseh, Michigan. III: second survey of the community. J Allergy Clin Immunol 1974; 53:127-38
15 Schachter EN, Doyle CA, Beck GJ. A prospective study of asthma in a rural community. Chest 1984; 85:623-30
16 Tager IB, Weiss ST, Speizer FE. Occurrence of asthma, nonspecific bronchial hyperresponsiveness and atopy: insights from cross-sectional epidemiological studies. Chest 1987; 91:114-19S
17 Anderson HR, Bland JM, Peckham CS. Risk factors for asthma up to 16 years of age: evidence from a national cohort study. Chest 1987; 91:127-30S
18 Burrows B. The natural history of asthma. J Allergy Clin Immunol 1987; 80:373-77S
19 Jarvik ME, Cullen JW, Gritz ER, Vogt TM, West LJ. Research on smoking behavior. Washington, DC: US Government Printing Office; 1977
20 Shopland DR, Brown C. Changes in cigarette smoking prevalence in the U.S.: 1955 to 1983. Ann Behav Med 1985; 7:5-8
21 Haynes R, Taylor D, Sackett D. Compliance in health care. Baltimore, Md: The Johns Hopkins University Press, 1979
22 Dodge R, Cline MG, Burrows B. Comparisons of asthma, emphysema, and chronic bronchitis diagnosis in a general population sample. Am Rev Respir Dis 1986; 133:981-86
23 International Classification of Disease, 9th Revision, Clinical Modification, vol 2. DHHS publication No. (PHS)80-1260, 1980
24 Martin AJ, Landau LI, Phelan PD. Lung function in young adults who had asthma in childhood. Am Rev Respir Dis 1980; 122:609-16
25 Orie NGM, Sluiter HJ, DeVries GA. The host factor in bronchitis. In: Orie NGM, Sluiter HJ, eds. Bronchitis: an international symposium. Assen:Royal Van Gorcum, 1961:43-59
26 Bailey WC. Symposium on asthma. Clin Chest Med 1984; 5:555-56